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ABSTRACT

This report provides a broad survey of the current state of television training technology in civilian and military situations, including detailed information concerning a variety of specific applications at local Navy training facilities in the San Diego area. The relative effectiveness of the existing conventional and unique utilizations of television is studied, and recommendations are made regarding the feasibility of applying existing systems to other Navy contexts or to developing modified or innovative systems. The research information presented includes data pertaining to specific equipment types, personnel requirements, and cost and training factors associated with typical television systems. The effectiveness of television as a potent and diversified training tool is confirmed in a wide variety of research findings and demonstrated in a broad range of operational training situations. The most prevalent training use of television is simply as a device to present filmed instruction in a classroom. The more effective utilizations of television, however, appear to be those applications which capitalize on the unique capabilities of the medium, such as in providing immediate performance feedback or in supplying visually programed task direction. (Author)

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NAVAL PERSONNEL AND TRAINING RESEARCH LABORATORY

SAN DIEGO, CALIFORNIA 92152

RESEARCH REPORT SRR 70-19

FEBRUARY 1970

A SURVEY OF TRAINING-RELATED UTILIZATIONS OF TELEVISION

Ruth A. Hansing
Eugene W. Matlock

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by

Ruth A. Hansing
Eugene W. Matlock

February 1970

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Research Report SRR 70-19

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SUMMARY AND CONCLUSIONS

Problem

Television is being utilized in a wide variety of applications in military and civilian training situations. Research is required to evaluate the many existing and proposed television utilizations in terms of possible applications to specific Navy training contexts.

Background and Requirements

The potential utility of television as an effective training tool has been well recognized by the Navy and other military and civilian training systems. During the past two decades television facilities have been implemented in many Navy training situations, to serve a wide range of training objectives. The present investigation is designed to provide the basic information and first-hand knowledge required for determining the relative effectiveness of existing television utilizations, and for directing the development of future instructional systems incorporating television.

Approach

Two concurrent approaches and informational sources were utilized in the conduct of the present investigation. (1) An intensive review and evaluation of relevant research literature was conducted and (2) personal visits were made to observe operating television facilities in the area.

The resultant information from both sources included data pertaining to specific equipment types, personnel requirements, cost, training factors, and general research results based on experimental training applications. Summarization of findings and ensuing recommendations pertain to the relative effectiveness of existing television utilizations and the feasibility of applying existing or newly developed systems to other Navy training contexts.

Findings, Conclusions, Recommendations

The effectiveness of television as a potent and diversified training tool is confirmed in a wide variety of research findings and demonstrated in a broad range of operational training situations. The most prevalent training use of television is simply as a device to present filmed instruction in a classroom. The more effective utilizations of television, however, appear to be those applications which capitalize on the unique capabilities of the medium, such as in providing immediate performance feedback, or in supplying visually programmed task direction.

Resultant recommendations regarding television utilization include efforts toward increasing the standardization of equipments, (pp. 18-22, pp. 31-33), expanding programs for training Navy personnel in television production, operation and maintenance, (p. 33), increasing the production and use of kinescopes as training films (pp. 5-6, pp. 33-34), and emphasizing the special viewing characteristics and capabilities of television in a maximum variety of training situations (pp. 11-17, pp. 33-35).

It appears that increased informational exchange and greater equipment standardization among Navy facilities should result in increasingly effective exploitation of the potential capabilities of television as a major training resource.

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A SURVEY OF TRAINING-RELATED UTILIZATIONS OF TELEVISION

A. Background and Purpose

The potential utility of television as an effective training tool has been well recognized in the Navy, and in other military and civilian training systems. During the past two decades television facilities have been implemented in a variety of Navy training contexts serving a wide range of training objectives.

Continuing research is required to determine the feasibility of the many existing and proposed television utilizations in terms of possible applications for general and specific Navy training operations. The present investigation provides the basic information and first-hand knowledge prerequisite for further research in the development of models for instructional systems incorporating television.

This report provides a broad survey of the current state of television training technology in civilian and military situations, including detailed information concerning a variety of specific applications at local training facilities. The relative effectiveness of existing conventional and unique utilizations of television has been studied with resultant recommendations regarding the feasibility of applying existing systems to other Navy contexts or developing modified or innovative systems.

The research information presented includes data pertaining to specific equipment types, personnel requirements, cost, and training factors associated with typical television systems.

B. Approach

This investigation of the training utilizations of television involved two concurrent approaches and informational sources: (1) An intensive review and evaluation of relevant research literature, and (2) personal visits to operating television facilities.

1. Literature Sources

The search of the literature was conducted with an emphasis on uses of television in educational or training programs, and on military utilizations of TV. All descriptions of television use, except those for purely entertainment purposes, were included in the area of interest. Although many of the articles surveyed concern non-military contexts, the findings have direct relevance for military utilizations.

Sources of relevant articles included the various psychological journals of the American Psychological Association, medical publications and other journals, such as AV Communication Review, which are concerned with television as a communication medium. A search was also made of DDC (Defense Documentation Center for Scientific and

Technical Information) literature. This search covered technical reports derived from research and development activities of the Department of Defense.

Information from the surveyed literature has been grouped for greater clarity into the following five general subject categories representing different aspects of TV utilization: (1) The State of Educational (or Instructional) TV, (2) The use of TV in Classroom Instruction, (3) Televised Instruction with Active Student Participation, (4) TV as a Feedback Device, and (5) Special Viewing Capabilities of Television.

2. Television Facilities

Visits were made to virtually all existing television facilities operated by the Navy and the Marine Corps in the San Diego area, and to the television section of the Speech Arts Department of San Diego State College. In cases in which the same system was duplicated in several places (such as the PLAT system which exists on all aircraft carriers in the Pacific Fleet) only one representative facility was visited.

A heavy concentration of television facilities in the San Diego area provides an exceptional sampling of the types and applications of military television nation-wide. Personal visits to these facilities provided the opportunity to observe, first-hand, a variety of television systems and functions in operational context. An effort was made to note the unique or innovative features of each facility and to consider promising applications in terms of proposed future research areas. Uniform data regarding available TV equipments, personnel, and utilization were collected from each of the facilities by means of a structured questionnaire.[1] Additional practical information and advice concerning television utilization was also obtained through informal discussions with facility personnel.

The following listing identifies the individual facilities which were personnally visited by the survey team:

a. Navy. Television facilities visited within the Navy may be divided into those under Bureau of Medicine and Surgery (BUMED), Bureau of Naval Personnel (BUPERS), and Naval Air Forces, Pacific Fleet (COMNAVAIRFORPAC).

(1) Bureau of Medicine and Surgery

(a) Hospital Corps School, Balboa Naval Hospital, San Diego

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[1]A Navy-wide survey of similar factors relating to television equipment and utilization has been conducted, by means of mail questionnaires, by the Office of the Chief of Naval Operations.

(b) Dental Technician School, Naval Training Center, San Diego

(c) Radiology Department, Balboa Naval Hospital, San Diego

(d) Urology Department, Balboa Naval Hospital, San Diego

(2) Bureau of Naval Personnel

(a) Recruit Training Command, San Diego

(b) Naval Amphibious School, Coronado

(c) Fleet Training Center, Naval Station, San Diego

(d) Fleet Anti-Submarine Warfare School, San Diego

(e) Service School Command, Naval Training Center, San Diego

(1) Machinery Repairman School

(2) Personnelman School

(3) Instructor Training School

An interview was also conducted with several staff members of the Training Aids Facility, San Diego, which supervises all BUPERS television facilities in the area.

(3) Naval Air Forces, Pacific Fleet

(a) Pilot Landing Aid Television (PLAT system). This system is installed on all 13 aircraft carriers in the Pacific Fleet. Visits were conducted to:

(1) PLAT Control Center, North Island Naval Air Station, Coronado.

(2) PLAT equipment maintenance center, North Island.

(3) USS KITTY HAWK (CVA-63)

(b) Shipboard Entertainment System. This system is installed on all 13 aircraft carriers in the Pacific Fleet. Visits were made to:

(1) Public Affairs Officer, COMNAVAIRPAC, North Island Naval Air Station, Coronado (central control for the entertainment system).

(2) USS KITTY HAWK (CVA-63)

(c) Fleet Weather Facility, North Island Naval Air Station, Coronado.

b. Marine Corps.

(1) Landing Force Training Center, Naval Amphibious Base, Coronado.

(2) Mobile Televison Unit, Marine Corps Recruit Depot, San Diego.

c. Civilian. The television studio and the television training program within the Speech Arts Department at San Diego State College served as the major source of information concerning civilian televison facilities.

Although the total number of TV facilities visited within the Navy and Marine Corps was not large nor statistically representative, the sample actually provides a good practical representation since it includes a sizable percentage of the total TV facilities within these military services.

It has been estimated that approximately 50 percent of all BUPERS television facilities within the Navy are located in the San Diego area. Within BUMED the facilities at San Diego, Great Lakes, and Bethesda apparently represent the three major TV facilities operated by the Navy for medical training and, similarly, the only Dental Technician School operated by the Navy is located in San Diego. Televison usage within the Naval Air Force is well represented in San Diego with two large naval air stations and the Commander of Naval Air Forces in the Pacific all located in the area.

The Marine Corps at this time has relatively few television installations. The mobile TV facility at the Marine Corps Recruit Depot is an experimental prototype upon which future development of TV systems within the Marine Corps will be modeled.

C. Findings of the Literature

1. The State of Educational Television

Television has been recognized as a possible means of solving the steadily worsening problem of overcrowded classrooms and lack of qualified instructors. Televised instruction has been instituted at all levels of the educational process--from elementary school to post-graduate training. Many training programs within the military services have made use of TV.

a. Live Television. The simplest method of using television is to observe on TV monitors what the camera is picking up, without recording the image. Television is often used in this manner to relay a TV image of an ongoing lecture or program to numerous additional lecture halls in order to increase the number of students able to observe an event. Live TV is also used for magnification to enlarge

closeup views of demonstrations such as surgical procedures. Another important use of live TV is for observation or surveillance, such as allowing a student teacher to monitor a classroom in operation without being physically present as an unusual stimulus in the classroom.

b. Videotape. The TV image can be preserved for use at a later time by recording the image on videotape. This method increases the cost of TV production by necessitating the use of a videotape recorder (VTR) for recording and playback of the tape. In many situations, however, the unique advantages of videotape justify the extra expense and technological demands.

The most obvious advantage of videotape is that outstanding presentations may be captured on tape and replayed many times. This makes it possible for all students at a school to be exposed to lectures by the most gifted instructor on the staff. It also means that demonstrations such as difficult laboratory experiments can be repeated until a perfect demonstration has been taped; and that more complex demonstrations can be performed than would be possible in individual classrooms or laboratories.

The reuse of videotaped lessons has the added advantage of assuring uniformity in the content of instruction for large numbers of students. This is a factor which has been seriously lacking in some educational programs, including military training. In educational research the uniformity of videotaped lessons can also contribute to the control of experimental variables.

Although use of instructional television, including use of taped lessons, does not, in and of itself, guarantee quality of instruction, there are many ways in which the use of videotapes can contribute to increases in the quality of instruction. The instructor is freed from the chore of repeating the same lecture to several different classes, therefore allowing him more time for research, for counseling students, and for preparing lessons. The use of videotaped lessons also exerts a subtle pressure on the instructor to organize his lecture more carefully and attempt to overcome annoying habits of presentation since mistakes, hesitations, and odd mannerisms appear more glaringly obvious on the TV screen than in person. For many instructors, viewing themselves on TV may serve as a valuable feedback device to point out needed improvements.

The use of videotapes for feedback purposes is proving to be a valuable educational tool for students as well as instructors. The student can be taped while practicing some action such as a motor skill or a speech. The student's later observation of the tape is then accompanied by self-critique and/or criticism by an instructor.

c. Kinescopes. Videotapes may be converted into kinescopes, which then can be shown on regular film projectors. Although there are many similarities between kinescopes and training films, sizable time and economic advantages favor kinescopes.

These advantages arise from the fact that production of videotapes is faster than film production and free from the "traditional" methods and costs of film production. A videotape may be viewed immediately after recording by playing it back on the VTR. If the tape is unsatisfactory the sequence may be reshot immediately. Films generally cannot be immediately reviewed and re-shot because of the relatively longer time required for the developing process.

Largely because of reduced production time, production costs for videotapes are much lower then for films. Also, although the initial cost of videotape is greater than that of film, the ultimate expense of the film is greater because it cannot be erased and reused as videotape can. The expense of converting videotape to kinescope is relatively small. It has been estimated that the ultimate cost of training film production may average $1,200/minute as compared to $100/minute for kinescopes.

One disadvantage of kinescopes is that the process of converting videotapes to kinescopes does result in some slight loss of picture quality. Therefore the picture quality of a training film is usually slightly better than that of a kinescope.

d. Advantages of Videotapes. Use of videotapes offers some advantages over use of either training films or kinescopes. While both films and kinescopes are projected onto a screen which usually requires a darkened room for good viewing, videotapes may be shown on a TV screen with normal room illumination. This facilitates note taking and inhibits sleeping.

Most educational TV systems use closed circuit TV (CCTV). In CCTV the signal is sent from VTR to monitor via cable. The VTR can be located in a central studio where videotapes are played on the VTR and sent out by cable to the monitors in the individual classrooms. This is a simpler procedure than showing films because it eliminates the necessity of transporting projector, screen, and film to the classroom where it will be used.

e. Summaries of Educational TV. The general advantages and disadvantages of TV as an educational medium have been reviewed by many including Tyler.(53) Advantages he cited include ability to magnify both visual and auditory stimuli (such as views through the microscope and amplification of insect sounds); efficiency of presentation due to pressure on the instructor to plan the lessons carefully; enhancement of selective attention to the lesson because the TV image is brighter than its surroundings; impact of unique TV features such as split screen presentation; and more direct address and eye contact with the individual student via the TV screen. Disadvantages include limited detail; limited contrast of image; exaggeration of fast action; necessity for continuous flow of the lesson; and the lack of feedback to the instructor thus depriving him of clues to slow down, repeat or elaborate.

Steinemann (49) noted similar features in evaluating the use of TV in electronics training courses within the Navy and Air Force. The use of videotaped lessons offered the following advantages: course material may be edited for the most flawless delivery; the tape may be used for innumerable uniform presentations; and tapes represent a fraction of the cost of training films. Disadvantages include loss of spontaneity and viva-voce presentations; relative inflexibility of lessons; and less opportunity for free student response and reaction.

In summary, it would appear that the advantages of educational television generally far outweigh the disadvantages; that kinescopes offer a significant economic advantage over training films with little loss of quality; and that educational television is a versatile medium and can be employed in many situations in addition to standard classroom use. Classroom television is often mixed with live lectures and discussions in an effort to avoid loss of student participation and interest which might result if presentations were totally without personal elements.

2. The Use of TV in Classroom Instruction

a. Studies of the Effectiveness of Televised Instruction. The most common use of TV as an educational tool has been simply to substitute televised lessons for conventional live presentation by an instructor in the classroom. Many studies have evaluated the relative effectiveness of these two methods of teaching.

The majority of these studies have found that televised instruction and conventional instruction are not significantly different in learning effectiveness. Examples of this include Lepore et al (30) who found that with both high school and college students there was no difference between televised instruction and conventional instruction for acquistion of information, essay writing, critical thinking, and self-insight.

Alexander (1) studied the use of TV lectures in college mathematics courses and found no differences in mean achievement between sections receiving TV lectures and those receiving classroom lectures. Evans, Roney, and McAdams (12) obtained the same results in elementary psychology and biology courses. Acquistion of skills in a communication skills course was little different for TV sections and regular classroom sections (3). Acquistion of subject-matter knowledge in eight undergraduate courses as measured by objective retest performance was not adversely affected by assignment to sections taught by CCTV as compared to sections taught by conventional methods (46).

Benschoter and Charles (4) studied retention scores for students who had received instruction in general psychology under one of four different conditions: traditional classroom groups, off-campus TV groups, TV-in-studio class, and kinescope. Results showed that retention of the material after three years was as good for the TV

classes as for the traditional group. Similar results were obtained by Siegel, Adams, and Macomber (48) who measured retention scores after one year for subject matter presented in nine college courses.

Another sizable group of studies have found that the effectiveness of TV instruction not only equals but actually exceeds that of conventional instruction. Anastasiow and Espinosa (2) studied TV instruction in elementary Spanish and found that TV produces an increase in student achievement in listening comprehension. Standardized tests of students in ninth grade science who were instructed by TV learned more than those instructed in the conventional way (43). Yonge (56) concluded that the use of closed-circuit TV far surpassed any other technique used for teaching psychotherapeutic interviewing to medical students.

Few studies have found TV instruction to be less effective than conventional instruction, although McKeachie (34) in a review of the literature concerned with improvement of instruction states that closed-circuit TV seems to be slightly inferior to conventional instruction for most outcomes.

b. Military Use of Televised Instruction. Some of the earliest studies of the effectiveness of TV instruction were done with the military services. A study of Navy reservist training begun in 1949 (51) asked the question "Do men taught by television learn as much as men taught by conventional classroom instruction?." The results showed that for the officers tested, television teaching was more effective than teaching by the local instructors in 50 per cent of the comparisons made, and just as effective in another 38 per cent. For enlisted men TV was more effective in 53 per cent of the cases and just as effective in another 20 per cent.

The Army has conducted several large scale studies of television use in military basic training. In 1953 Kanner, Runyon, and Desiderato (27) compared the information and skills obtained in basic training from TV instruction and regular instruction. They found that the most striking influence of TV instruction was on low aptitude trainees, with these subjects learning more from TV than their counterparts did from conventional instruction. An attempt was made by the same authors to pinpoint areas of subject matter in which TV instruction was most effective (9). Their findings indicated that televison instruction was superior to regular instruction in subject matter involving the manipulation of small parts, paired associate learning, and the teaching of relationships among moving parts. For course content more typically ammenable to lecture or lecture-demonstration, televison instruction did not provide superior results.

In a later study of Army basic training by Kanner and Marshall (25) one company received all classroom instruction via TV, and the other group received classroom lectures by instructors. In addition,

the TV group received extra after-hours instruction on a TV monitor placed in the barracks. These sessions were called "review-preview." Both conventional and TV companies were tested immediately after each instruction session, and again at the end of the eight-week course. In the tests given immediately after instruction, the achievement of the TV company was better than that of the conventional company in most of the comparisons made; but in the test at the end of basic training the superiority of the TV group was of a much greater magnitude. Since the "review-preview" technique as used in this experiment could be expected to have a much greater impact on the final scores than on the immediate scores, this factor may have been largely responsible for the final test score superiority of the TV group. In this study both high and low aptitude trainees learned better from TV than their counterparts did from conventional instruction.

c. Level of Ability and Televison Instruction. The Army studies indicating favorable results in the use of televised instruction for low-ability personnel (25, 27) were influential in the conception of "Project 100,000" which had as its primary purpose the training of low-aptitude personnel for military service. Television was identified as a major tool to be used in the training of these personnel (24).

The question of whether level of ability influences the degree of benefit derived from instructional TV was investigated by Jacobs, and Bollenbacher (21). Science instruction for high, middle, and low ability sixth grade students were administered by either TV or classroom instruction methods. Results indicated that TV group averages exceeded non-TV group averages at the high ability level; there was little difference at the middle level; and the non-TV group got higher averages at the low ability level. Other investigators (48) have reported that the performance of high ability college students as measured by objective final exams was not affected by assignment to sections taught by various experimental methods including television, but low ability students were occasionally penalized by class assignment to a TV section.

d. Attitudes towards Educational Televison. In addition to evaluating the effectiveness of TV in promoting learning, many investigators have also been interested in attitudes of students and teachers toward educational TV.

Many studies have found attitudes toward TV instruction to be generally favorable. Seventy per cent of students in an elementary psychology course, in which half of the sessions were taught by television, said they would take another course using TV (11). These results agree with those of Gable (15) who conducted a survey to determine the reaction of pupils, teachers, and parents to classroom TV. Results in terms of a like-dislike questionnaire proved to be very favorable to TV. Carpenter and Greenhill (8) studied the use of TV in elementary chemistry and psychology courses and found that the method was acceptable to students and administration; faculty members, however, indicated rejection or non-preference of educational TV. Semantic Differential

Scale responses of students in a TV-taught ninth grade algebra course showed more favorable responses to course concepts, the course itself, and the course materials and requirements than the responses of students taught by conventional means (54). High school and college students taught by TV were found to give fewer negative reactions to teacher technique than students taught by conventional instruction (30).

An early study of training of Navy reservists by television (51) evaluated their opinions of the TV course after its completion. When asked to compare the TV programs with other Reserve training programs, 96 per cent of the officers and 82 per cent of the enlisted men rated the TV presentations above average in interest appeal. Seventy-two per cent of the officers and 56 per cent of the enlisted men rated the TV series as more instructive than the average training films they had seen within the last two years.

Some studies have revealed negative attitudes toward televised instruction. Becker and Dallinger (3) found that students initially seemed to prefer conventional instruction, but increasing experience with televised instruction made them more favorable toward it. Ninth grade science students who received conventional instruction expressed more consistently favorable attitudes toward science, the method of instruction, and the teacher, as compared to attitudes of students who received TV instruction (43). Moskowitz (35) found that studying foreign language by TV produced negative attitudes in elementary school children toward foreign language. This result is in opposition to the finding by Anastasiow and Espinosa (2) that addition of TV instruction in Spanish to the classroom does not appear to influence children's attitudes toward learning Spanish.

Siegel and Macomber (46) studied TV-taught and control sections of eight college courses. They found that students in TV sections rated the course less favorably than did students in the control sections; student ratings of instructors were not affected adversely by TV; and high ability students tended to be less favorable toward TV classes than did low ability students.

Janes (22) attempted to correlate personality characteristics and IQ of students with their preference for televised or classroom lecture. Studying pupils who had been exposed to TV lectures in a college social science course, he found that self-confidence was most highly correlated with preference for TV lectures; IQ scores were somewhat less highly correlated; and "authoritarian identification" was slightly positively correlated.

e. Summary of Classroom TV Instruction. Several authors (18, 52) have pointed out that when the vehicle of television is used merely to present a standard lecture there is no reason to expect that it will be more effective than similar conventional classroom instruction by a live instructor. The weight of evidence from the studies comparing conventional instruction and TV instruction seems to support the

contention that the two methods produce similar results. Consideration of these studies should take into account the fact that many of the early studies comparing these two methods were done not to find out whether TV instruction was superior to conventional instruction, but simply to make sure that it was not inferior. Many educators were fearful that by utilizing the economic and other advantages of televised instruction they might be penalizing the students by presenting an inferior method of instruction.

Research evidence about the interaction of level of ability with benefit derived from televised instruction is rather contradictory. Some studies found that high-aptitude subjects benefit most, while other studies showed TV instruction to be relatively more beneficial to low-aptitude people. This apparent contradiction may be a function of the instructional content or the ways in which television was employed in instruction.

Studies of attitudes of students toward televised instruction do not present a consistent picture, although the number of studies finding generally positive attitudes was greater than the number which found negative attitudes.

3. Televised Instruction with Active Student Participation

In order for television instruction to be significantly more effective than conventional instruction it appears necessary that TV be utilized in a manner which makes best use of its unique audio-visual capabilities. One of the more promising modifications of instructional TV is the incorporation of devices which require some type of active response by the student.

Students in a telecast physics course who were exposed to the technique of overt response and immediate confirmation made significantly higher scores on a post-program test than did the control group (10). Nasca (36) studied junior high students receiving science instruction through closed circuit TV. One group was required to make active responses - both verbal and written. The basis for overt response was provided by short programmed sequences directed from the studio, and worksheets and diagrams to be completed during the presentation. Active participation was found to be one of the most effective methods utilized, and students responded to it with enthusiasm.

An innovative TV teaching technique allows students to respond by answering multiple choice questions interspersed in a TV lecture (41). Each student sits at a unit consisting of a small TV monitor, five push buttons, and a set of earphones. Students watch a large TV monitor at the front of the class, and when the TV instructor asks a question all the possible answers are displayed on the student's individual monitor. The student presses the button corresponding to the answer which he considers to be correct. Following his response, the correct answer appears on his monitor screen and a voice in his

earphones tells him whether he was right or wrong, and why. This somewhat elaborate system is commercially available, but there are simpler systems, utilizing only the push button element, which are gaining increasing use in many classrooms. These "classroom communicators," as they are called, can operate with a live instructor or a filmed lesson as well as a televised lesson presentation (14). The advantages of this type of system are that the instructor can receive feedback from the students during his presentation; a record of each individual student's responses can be kept; and student attention is maintained through forced active participation.

a. Military Studies. Kanner, Runyon, and Desiderato (26) found that television proved particularly effective as a training device for Army trainees when they were required to manipulate equipment or learn motor skills as they followed an instructor on TV. This method was used for instruction in machine gun disassembly and in the manipulation of a map and compass for determining azimuth.

The U. S. Army Air Defense School at Fort Bliss, Texas, set up a rather elaborate TV system to be used in electronic and guided missile trouble-shooting training (23). The bulky missile equipment was placed in the TV studio with a skilled repairman in attendance, and the studio connected by a two-way communication system to a classroom. Troubles were injected into the missile system and the symptoms were shown on scopes and meters presented on the classroom TV monitor. Individual students in the classroom used a microphone to direct the repairman in the studio in locating the trouble. The TV camera picked up the various meter readings requested by the student and they were displayed on the classroom monitor. Other students were encouraged to comment on the troubleshooting information, showed better orientation, and worked more rapidly than students not receiving this type of TV training.

b. Programmed Instruction. Programmed instruction is a concept which has been incorporated into televison teaching with generally favorable results. Gropper and Lumsdaine have done an extensive series of studies investigating integration of programmed learning into TV instruction. One of the major advantages of programmed learning has been the self-pacing aspect, in which the student proceeds at a rate which he selects for himself. Although TV can be used to present programmed instruction to individual students, it is more often used for group instruction. Gropper and Lumsdaine (18) point out that programmed teaching to a group eliminates the possiblity of self-pacing, since the program must proceed at a fixed instructor-determined rate for the entire group. Therefore, "programmed group instruction" requires careful pretesting of the lesson pace, plus homogeneous grouping of students to whom the material is presented.

Gropper and Lumsdaine (17) discovered that the process of active responding in itself did not lead to more effective learning when non-programmed stimulus materials were used; and that merely exposing the student to programmed lessons without requiring active

student response did not enhance learning (16). Therefore, a combination of programmed lessons plus active student response is essential to make fully effective use of this TV teaching method.

Achievement test scores of junior high school science students who watched and responded actively to a programmed TV lesson were compared with those of students who passively watched a conventional TV lecture (18). While the students exposed to the programmed lesson scored higher than the other group, the difference was significantly greater only when the high IQ students were compared - probably indicating that the programming of the lesson content was adequate to elicit correct responses only from high IQ students. An earlier finding by Gropper and Lumsdaine (17) indicated that frequent incorrect responses in a programmed TV course had no beneficial effect on learning, suggesting it is only correct responding that makes programmed TV instruction effective.

Post test scores of students in a conventional TV course in college economics were compared to those of students who had participated in a programmed TV lesson revision of the course (33). The mean achievement increment was significantly higher for students exposed to the programmed lessons. Students viewing the programmed lessons also expressed more generally favorable opinions toward the course than the students exposed to the conventional TV lessons.

A detailed discussion of "The feasibility of 'programmed' television" has been offered by Gryde (19). He concluded that television is capable of meeting most of the criteria for presenting good programmed instruction, but is somewhat deficient in the areas of self-pacing, feedback, and active response. Gryde suggested ways in which these deficits may be overcome. The self-pacing aspect might be improved by developing methods for preprogramming pacing rates for groups, and by presenting the material to homogeneous audiences. Television can provide feedback to students in terms of providing knowledge of results, but cannot accommodate individual differences. Research in multiple track programs may eventually provide this accommodation. Television instruction usually provides no feedback to the instructor, but this lack could probably be overcome by use of extensive pretesting of lessons, by providing a two-way communication system between student and instructor, and by use of the "classroom communicator" type system. The usually passive nature of televised instruction must be changed by designing program types and formats that will elicit active student response.

c. Summary. Studies investigating the use of active student response in televised instruction have generally found that student response activity produces favorable results in terms of learning and student attitude. A wide variety of active response is possible from answering questions presented in the TV lesson to a motor response such as following directions for using a compass.

The technique of programmed instruction has been used with some success in television teaching. Programmed instruction has been

primarily designed for instruction on an individual, self-paced basis. Since televised lessons are used more efficiently for group instruction, and since they usually proceed at a fixed pace, modifications of programmed instruction are necessary before the method can be fully adapted to use in educational television.

4. TV as a Feedback Device

The use of feedback to students in televised programmed instruction has already been mentioned. This type of feedback is usually in terms of providing knowledge to the student of whether he has responded correctly to a question presented in the programmed lesson.

The unique features of TV have made possible a much more innovative use of feedback in the educational process. Students can be videotaped during the learning process and the tapes played later so that the students can observe their own behavior.

At the present time one of the most extensive uses of the videotape feedback method is in the training of instructors. In a study of student teacher training methods, student teachers were observed by one of three different methods: (1) direct observation by the supervisor in the classroom; (2) observation by the supervisor from the control room and later viewing by student and instructor of kinescopes of the student's performance; (3) classroom observation by the supervisor plus later kinescope viewing by student and instructor. Results indicated no significant differences in the effects of the three methods, but the subjective reactions of student teachers and supervisors supported the utilization of kinescopes (45).

The military has also utilized TV in instructor training schools. The Army Signal School at Fort Monmouth, New Jersey, was asked in 1958 to conduct a study evaluating the use of videotape recording for improvement of instructor training. The student instructor was taped while giving a presentation and then he viewed the tape. According to Kanner (24), the method proved so successful within a few weeks that the use of videotape was integrated into the instructor's training course without further study.

Videotape playback has been effectively used in medical training (40). Medical students were taped while taking histories, doing physical examinations, and making diagnoses. Staff and students viewed and evaluated the tapes.

Videotape feedback is also being used in other than purely educational situations. Burkland (6) described the use of videotape playback as a tool in the correction of articulatory problems. Movements of the patient's mouth were videotaped, and the patient then observed the tape. The effectiveness of this method of therapy was attributed to several factors, including the magnification of the size of the mouth on the TV screen, and the fact that patients are not so emotionally affected by seeing themselves on TV as by observing

themselves in a mirror. Weiner (55) reported that videotape playback can be used in the treatment of psychiatric patients. Alcoholic patients taped during psychodrama therapy benefited from observing themselves later on TV.

a. Summary. Portability and the capability for videotape recording make television well suited to use in feedback situations. Since modern TV systems are not tied to the studio activities may be taped in the classroom, in the laboratory, on the playing field, etc. One of the most important features of television recording is that a videotape may be played back as soon as it is made, thus allowing immediate feedback. Videotapes can also be easily stored for use at a later time. This permits delayed feedback, and also makes possible comparison of tapes made at different stages in an individual's learning process.

5. Special Viewing Capabilities of Television

There are a variety of situations in which TV is used primarily to facilitate either viewing of some event, or communication from one area to another. In many cases live broadcasts are adequate for the desired purpose.

a. Magnification. TV has been used to present a magnified picture of various objects. Potts, Volk, and West (42) describe a situation in which a closed-circuit TV system was set up to present an enlarged image of reading material to people with subnormal vision. Although the method proved very successful, cost is currently prohibitive for any practical use. The use of television to magnify mouth movements in patients with articulatory problems has already been described (6).

b. Close-up Viewing. Many demonstrations are complicated by the necessity for the observer to see certain minute details. When a demonstration is being presented to a large group, this usually results in crowding around the site of the demonstration, and long delays to allow each observer to get a close-up view. When the demonstrator uses a television camera to present a close-up view on the TV monitors, these problems are eliminated. The close-up view may be presented normal size, or magnified if desired.

Laboratory demonstrations in a pharmacology course were replaced by televised demonstrations which permit closer observation than would be possible in the laboratory situation (28). Cameron (7) described an experiment in which five Philadelphia medical schools were linked together by closed circuit TV for the purpose of observing live lectures on forensic pathology. With the camera on his microscope, or just above the operating table, the lecturer was able to demonstrate fine details. Live presentation was an advantage in this case because students were allowed to question the lecturer through a two-way phone system. The Army has also used television at Walter Reed Medical Center to provide close-up views in surgery and autopsies (23).

Kanner (24) reports that television is now used frequently in the Army to show the operation and components of various types of equipment. The close-up advantages of TV are especially useful in this context.

c. Communication. The medical profession has been making increasing use of television as a means of communication between doctor and patient in situations in which it is difficult for them to meet in person. In Boston, a TV link exists between a first aid station at the city airport and the emergency room of a major city hospital (40). A nurse on duty at the airport station alerts the emergency room when a patient with evidence of a serious medical problem reports to this station. A doctor at the emergency room observes the patient via TV and directs the nurse in an examination of the patient, while the patient views an image of the doctor on a TV monitor.

Psychotherapy via TV communication has been instituted in several places. The Nebraska Psychiatric Institute in Omaha has established a link with an isolated state hospital, and this link is used for education, diagnosis, treatment, and collaborative research (5). At the California College of Medicine it has been found that a feature of psychotherapy via TV is that the patient can indicate inattention during a therapy session by reducing or turning off the sight and sound of the therapist (32).

A kind of one-way communication was used to administer the Peabody Picture Vocabulary Test to children in group TV sessions (13). Results were comparable to those obtained from administering the same test individually to the same children.

d. Observation. A television system may be used simply as a visual monitor. This monitoring function is advantageous in situations where the observer wishes to view an event without intruding his physical presence into the situation, or when one wishes to monitor distant or otherwise obscured areas from a stationery position.

The use of TV to allow observation from a distance is demonstrated in a study reported by Lockard (31) in which TV observation was successfully used in an experimental effort to shape avoidance behavior in chair-confined monkeys.

Stollen and Lesser (50) studied the effectiveness of TV in providing observational material for a college teacher training course. Three techniques for students to observe classroom teaching were compared: (1) in-person observation; (2) observation via "live" TV; (3) kinescope observation. An essay exam assessing ability to evaluate critically the observed classroom session revealed that both kinescope and "live" TV were superior to in-person observation.

An example of TV used to monitor hard-to-see areas is reported by Lazet (29). The Canadian Navy has experimented with placing closed-circuit TV cameras on destroyers so as to relay pictures to the bridge from areas of the ship, such as the stern and helicopter flight deck, which cannot be seen from the bridge.

e. Summary. The unique characteristics of television are being increasingly utilized in innovative applications of TV. This section has dealt mostly with descriptions of attempts to take advantage of the special viewing capabilities of television. Many of these uses have not yet been long enough established to have had their effectiveness fully investigated by experimentation, however, some of them offer promise as effective instructional aids, job aids and monitoring and communication devices.

D. Findings from Visits to Television Facilities

The series of visits made to military TV facilities in the San Diego area revealed a great diversity among locations in terms of size of installation, types of TV utilization, personnel, and equipment. Data obtained from the visits will be discussed in three sections: (1) Equipment Information, (2) Personnel Information, and (3) Utilization of Television.

1. Equipment Information

a. Type of Equipment. Table I gives a condensed picture of the equipment and personnel at each facility at the time that facility was visited. Since neither equipment nor assigned personnel are static factors, some specific details of each installation may have been modified since the time the data were collected. A more detailed list of the equipment at each facility will be found in the Appendix.

The diversity among the facilities visited is well illustrated in Table I. The facilities ranged from a system with one camera and one monitor and no specifically assigned personnel, to a system which included six cameras, two videotape recorders, 48 monitors, and 11 full-time personnel. The "average" TV facility had approximately three cameras, two VTR's, 16 monitors, and three assigned personnel. (See Table I for actual means.)

From the Appendix it can be ascertained that there is wide variability in the types of cameras and VTR's found at the various military facilities visited. The 43 television cameras distributed among 15 facilities represented 20 different models. There were 11 different types of VTR's represented among the 31 VTR's at 14 facilities.

b. Operation of the TV System. All of the military TV facilities visited operated only closed-circuit (cable) systems. There are two basic ways in which a closed-circuit system can be operated: with video monitors or with radio frequency monitors. When video monitors are used the cable can carry only one channel at a time; but with radio frequency monitors several channels may be transmitted simultaneously through the cable.

TABLE 1

Equipment and Personnel at Military TV Facilities

Facility	No. of Cameras	No. of Lenses	No. of Recorders	Channels Used	No. of Monitors	Studio Space	Personnel
BUMED							
Hospital Corps School	3	1 zoom 6 fixed	2	2 & 4	58	Large studio with adjoining control room	3 CPO
Dental Technician School	4	1 zoom 4 fixed	1	Video monitors - no channel needed	10	Large studio with adjoining control room - remote camera locations in prosthetics laboratory	3 CPO 1 PO
Radiology Department	5	1 zoom 4 fixed	1	Video monitors	6	No separate studio space - set up in rooms where radiology equipment is used	No full-time TV personnel - operated by techs - physician
Urology Department	1	None	1	Video monitors	4	No separate studio space - set up in urology x-ray room	4 part-time PO's or SN 1 civilian

TABLE 1 (continued)

Facility	No. of Cameras	No. of Lenses	No. of Recorders	Channels Used	No. of Monitors	Studio Space	Personnel
BUPERS							
Recruit Training Center	6	2 zoom 8 fixed	2	3, 5, & 9	48	Large studio with adjoining control room	1 Officer 7 CPO 3 PO
Naval Amphibious School	3	4 zoom 15 fixed	4	3, 4, & 5	30 can project TV in ampi-theater	Large studio with adjoining control room - 3 remote locations - mobile van	1 Officer 1 CPO 1 PO 8 Civilians
Fleet Training Center	3	2 zoom 3 fixed	1	3	1	Large studio-classroom (no separate control room)	1 part time PO
Fleet Anti Sub-marine Warfare School	2	1 zoom 4 fixed	3	Video monitors no channel needed	3	Large studio-classroom (no separate control room)	1 part time PO
Machinery Repair-Man School	1	1 zoom 1 fixed	0	3	1	No separate studio space - set up in machinery repairman school workshop	No full time personnel usually operated by senior instructor

TABLE 1 (continued)

Facility	No. of Cameras	No. of Lenses	No. of Recorders	Channels Used	No. of Monitors	Studio Space	Personnel
Personnelman School	1	1 zoom 4 fixed	1	4	2	Small control room - shoot thru window into mock-up interview room - one remote location within building	No full time personnel most of school's instr. can oper. camera
Instructor's School	3	3 zoom 2 fixed	3	2 & 4	10	Large control room between 2 classrooms, can shoot thru windows into both classrooms	1 CPO
COMNAVAIRFORPAC							
PLAT Control	0	None	2	Not used	None except studio monitors	Medium-sized room for playing tapes and making kinescopes Large maintenance area	1 Officer Civilian techs for maintenance
PLAT USS KITTY HAWK	4	1 zoom 2 fixed	1	13	10 seen on one channel of enter. sys. (80 monitors)	Small control room with camera for recording data - 2 camera mounted under deck & one on island	2 PO

TABLE 1 (continued)

Facility	No. of Cameras	No. of Lenses	No. of Recorders	Channels Used	No. of Monitors	Studio Space	Personnel
COMNAVAIRPAC	3	1 zoom 10 fixed	5	Not used	None except studio monitor	Small control room - no studio	1 Officer 1 SN
USS KITTY HAWK Entertainment	2	1 zoom	1	6	80	Large studio - no separate control room	3 PO 1 SN
Fleet Weather Facility	1	1 zoom	0	Video monitors - no channel needed	9	No separate studio - space in weather control room	No full-time personnel - TV operated by weather control staff
MARINE CORPS							
Landing Force Training Center	2	2 zoom 5 fixed	2	Video monitors no channel needed	8	Large studio-classroom - no separate control room	1 Officer 1 NCO 1 PFC
Marine Corps Recruit Depot	4	3 zoom 9 fixed	3	Video monitors - no channel needed	8	Large studio-classroom - mobile van	1 Officer 3 NCO 2 PFC's

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TABLE 1 (continued)

Facility	No. of Cameras	No. of Lenses	No. of Recorders	Channels Used	No. of Monitors	Studio Space	Personnel
Total	48	26 zoom 77 fixed	33		288		56
Average Per Facility	2.7	1.4 zoom 4.3 fixed	1.8		16		3.1

It will be noticed from Table I that most of the radio frequency systems visited used the same channels. This is done to avoid using the channels assigned to commercial TV stations in the San Diego area. Leaving the commercial channels open eliminates the possibility of some slight cross interference between CCTV and broadcast TV, and also allows the CCTV monitors to receive these commercial channels if desired.

c. Special Equipment. Most of the military TV facilities visited did not have extensive equipment for special effects. Three facilities (Anti-Submarine Warfare School, Marine Corps Recruit Depot mobile van, and Amphibious School) had the capacity for producing split screen pictures. Split screen is the process of showing two or more separate pictures simultaneously in different portions of the screen.

Two facilities had audio systems which permit communication from the classroom to the TV studio. At the Instructor Training School each TV classroom is equipped with a microphone by which the instructor can call the studio and request that a specific videotape be played. A two-way communication system between classroom and studio is used at the Dental Technician School so that students can question the instructor while he is presenting a live TV demonstration.

Some of the facilities visited had mobile capabilities. The entire TV system at the Anti-Submarine Warfare School is portable, which permits it to be used at various locations including on board submarines. The Amphibious School has a mobile van to which studio equipment can be transferred and taken out into the field. The most completely mobile setup was found at the Marine Corps Recruit Depot which has a mobile van permanently equipped with an entire TV system including three cameras and a VTR.

d. Production Facilities. Studio facilities varied markedly among the places visited. The most elaborate studios were found at the Dental Technician School, Recruit Training Center, and Amphibious School. These are all facilities which carry on a fairly extensive amount of production in their TV studios, and thus need a more elaborate physical plant. All these facilities have large studio rooms (minimum 15' x 20'); separate control rooms with glass panels separating them from the studio; air conditioning; soundproofing; and professional lighting systems. Televised lessons were made realistic at the Hospital Corps School and the Dental Technician School by maintaining mockups of a small hospital ward and a dental treatment room in the respective TV studios. This allows televised "on site" demonstrations which are more effective than having an entire class crowd into a treatment room or ward to view a demonstration.

Kinescope facilities within the San Diego area are extremely limited. The only military facility with equipment for making kinescopes is the PLAT central control office at the North Island Naval Air Station.

2. Personnel Information

The diversity among personnel assigned to the various facilities visited was as great as the diversity of equipment. Some facilities had no full-time personnel assigned to the TV system, and many other installations had no assigned personnel with any special training in television. In contrast, a few of the larger, more active TV facilities, such as the Recruit Training Center and the Amphibious School, had large full-time staffs with some personnel trained in production techniques and other members of the staff experienced in operation and maintenance of the equipment.

a. Production Personnel. At present, neither the Navy nor the Marine Corps offer special training in TV production. Only one of the military TV facilities visited had an officer-in-charge with extensive training in the field of television, and this training had been received as a civilian. The only training of other military personnel at the TV facilities had been obtained through the television section of the Speech Arts Department at San Diego State College. Some of these personnel had attended a six-week workshop emphasizing "procedures and theories of television production as it pertains to closed-circuit and instructional use of television" which is offered at the college every summer (44).

There are relatively few civilian employees found at the military TV facilities visited. The Amphibious School was the only installation with civilian employees engaged in production and operation of the TV equipment. There several highly trained civilians were employed as production specialists.

b. Maintenance Personnel. The Navy does offer some training in the maintenance aspects of TV. The Interior Communication (IC) School at Great Lakes has a 19-week "C" school in television operation and maintenance. Apparently men in this rating are in short supply since only three of the TV facilities visited had any IC men among their personnel.

Several TV facilities depend on civil service technicians for maintenance of their TV system. At the Fleet Weather Facility, maintenance work on the TV system is performed by the civilian technicians of the Naval Air Station Public Works Department. PLAT control center has a large corps of civilian technicians whose sole responsibility is the testing and repair of the PLAT systems carried on each of the Pacific Fleet aircraft carriers.

Three facilities have neither maintenance personnel on their staffs nor access to civil service technicians. These facilities maintain contracts with civilian firms for maintenance service on their TV systems.

c. Levels of TV Personnel. The military rank or rate of the full-time personnel assigned to the TV facilities were, in general,

relatively high. In the six instances in which a commissioned officer served as OIC, his rank was lieutenant or higher. In three other cases, relatively senior chief petty officers were in charge. On the USS KITTY HAWK, both the PLAT system and the TV entertainment systems were operated by petty officers as the highest ranking full-time personnel, but they were supervised by officers with other duties in addition to the TV system. At the remaining five facilities there were no full-time personnel. Table 1 gives a rough breakdown of the personnel at each facility by rank/rate.

3. Utilization of Television

The TV facilities visited represent a broad range of the conventional and innovative applications of television to practical operations and training situations. Although some facilities were designed and utilized for a specific function, other facilities served a variety of different purposes. The following overview of local TV utilizations provides a basis for evaluation of existing operational uses in terms of possible applications to a variety of other settings.

a. Classroom Instruction. A few TV facilities use their TV systems almost exclusively for presentation of classroom instruction. At the Recruit Training Center, 39 per cent of all the classroom training given to the recruits is presented via television. Almost all of the TV lessons at this facility are preserved on videotape so that all classes of recruits are presented with the same lesson.

Daily videotaped lessons are also presented to students at the Hospital Corps School. In addition to student training at the school, this TV system is also used in the training of interns and residents at Balboa Hospital. Tapes dealing with various medical topics may be obtained from the Network for Continuing Medical Education and played for observation by the physicians.

Live lectures and demonstrations constitute the majority of TV presentations at the Dental Technician School. These live TV presentations are made more effective by a two-way communication system which permits students in the classroom to direct questions to the instructor as he presents the lessons from the studio. In addition to the live TV programs, the school also has a library of taped lessons which are routinely shown to all classes. Although classroom lectures are also generally presented live by an instructor at the Personnelman School, the instructors have taped many of their lectures to be used if the instructor is absent.

Taped lessons combining lecture by an instructor with film segments shot in the field are presented at the Landing Force Training Center. The staff at this facility is also developing taped lessons designed to replace field trips by the students to visit various ships and facilities. Classroom training by technical representatives is presented on the TV system at the Anti-Submarine Warfare School.

b. Active Student Participation. Several facilities have utilized active student participation in classroom TV instruction. Although the primary purpose of the TV system at the Amphibious School is to present classroom instruction via taped lessons, the staff has experimented with teaching methods other than the standard lecture tapes. They have developed a programmed course of training in reading flashing light Morse code, and are presently developing a programmed course in ammunition recognition. Programmed courses in "rules of the road" and "emergency ship handling" are also planned for future development by the Fleet Training Center TV personnel.

The course in preparing the dental room for the patient is taught at the Dental Technician School in a large room where each student has a dental chair and ancillary equipment to work with. A large TV monitor is used to present step-by-step instructions to the student, and the student performs each step with his own equipment as that step is presented.

c. Television Feedback. The use of television as a means of providing feedback to students or trainees was widespread at the facilities visited. The most common application of this technique is in instructor training programs. The Instructor Training School, the Landing Force Training Center, the Hospital Corps School, and the Communication School at the Marine Corps Recruit Depot all use, or have used, TV facilities to tape student instructors as they give presentations. Subsequently the student observes the tape for self-evaluation of his teaching technique. Upon entering the instructor training program at the Landing Force Training Center, each student receives a blank tape which he keeps for his individual use. Each student is required during the course of his training to give a five, ten, and twenty minute presentation, each of which is recorded on his own tape. The student keeps the tape in his possession and may take it to the TV studio at his own convenience to play it on the VTR.

Navy recruiters and vocational counselors are trained at the Personnelman School. During their training in interviewing methods, students are taped doing mock interviews and they then view the tapes for feedback on their interviewing technique.

Feedback for training in motor skills is provided by the TV system at the Naval Amphibious School and by the PLAT systems on aircraft carriers. The Amphibious School mobile van makes it possible to go out into the field and tape practice operations. This mobile unit is routinely taken to the beach to tape students in the coxswain course during practice combat landing operations. These students view tapes of their performance within hours after the tapes are made. Some experimentation has been done at the Amphibious School with installing these mobile cameras on firing ranges to record shell impacts during ships' firing practice. These tapes then provide some feedback on gunnery effectiveness to the officers and men involved in the firing.

On the aircraft carriers, two of the PLAT cameras are mounted under the surface of the flight deck and record views of approaching planes from this angle. Another camera is situated in an upper level of the carrier's island, from which it commands a view of the entire flight deck. These cameras operate continuously during periods when flight operations are occurring, and all launches and landings are recorded on videotape. After landing, the pilots are assembled in the squadron ready rooms and debriefed by the Landing Signal Officer. As part of the debriefing each pilot is shown the tape of his own launch and landing.

d. Special Viewing Capabilities. The live monitoring of the flight deck by PLAT system cameras is relayed to TV monitors at various stations around the ship where some supervision of flight operations occurs. In addition, on most carriers one channel of the entertainment TV system carries the PLAT system signal. This enables the men on the ship to observe flight deck activity on the entertainment system monitors. This has proved valuable in lessening the inclination of sailors to spend their free time on the flight deck watching launches and landings. Decreasing the number of non-essential people on the flight deck tends to decrease the number of injuries in case of an accident in this area.

A primary use of the PLAT system is as an aid to the landing Signal Officer (LSO) who is stationed on the aft flight deck, and is responsible for controlling pilots' approach attitudes during landings. He has a TV monitor at his station on which he receives an image of the incoming plane from one of the centerline deck cameras. Cross hairs on the lenses of these cameras are aligned with the landing surface on the deck of the carrier. The LSO can observe the image of the approaching plane in relation to these cross hairs and can tell whether the incoming plane will set down at the correct angle to the deck. If the plane's angle of approach is not correctly aligned with the deck, the LSO can direct the plane to a new approach and landing.

Some carriers also utilize the movable camera of the PLAT system in docking procedures. By putting the camera over the side of the ship, the captain can view an area of the ship which he cannot see from the bridge.

The PLAT system is also utilized in accident investigation. Since all launches and landings are recorded on tape, there is a record of any accident that occurs during these times. These tapes are then available for observation and analysis by an accident investigation team.

The TV systems at Balboa Naval Hospital are used in a variety of applications. Television monitoring is used in the Radiology Department for observation of patients receiving radiation therapy. From a station just outside the therapy room a technician can observe the

patient on a monitor, and move and focus the camera by remote control. This procedure allows the technician to observe the patient throughout the therapy session without having to enter the room and expose himself to high radiation levels.

A rather unique use of TV occurs in the radioisotopes section of the Radiology Department. Films of brain scans, liver scans, etc., are usually viewed on an x-ray view box consisting of a translucent screen with a light behind it. The Radiology Department staff utilizes a TV camera set up in front of the x-ray view box in order to observe an image of these films on a TV monitor. By adjusting the focus, brightness, and contrast of the image, questionable areas in the scan film can sometimes be made more clearly visible.

In both the Radiology and Urology Departments at Balboa Hospital, a device called an image intensifier is employed with a TV camera to monitor diagnostic fluoroscopy procedures. The image intensifier permits observation of functioning internal organs with lower levels of radiation than the classic fluoroscope method. Commercial image intensifier systems are equipped with provision for a TV camera to be directly inserted into the unit. When a TV camera is implemented into the system, the examining physician views the image on a TV monitor rather than on a fluoroscope screen. Use of a TV monitor enables the physician to observe the image without a period of visual dark adaptation. It also enables several physicians simultaneously to observe the image for diagnostic consultation or for training purposes. If a VTR is integrated into the system, a record can be made of the entire examination for later study or for training purposes.

Use of a TV system to facilitate observation by magnification is found at the Machinery Repairman School and at the Dental Technician School. At the Machinery Repairman School a camera is set up in the workshop next to the particular machine with which the lesson is concerned. The instructor operates the camera to present an enlarged image of various small parts of the machine on a TV monitor also set up near the machine. Students can simultaneously view the actual machine as a whole, and also the magnified image of the individual machine part under discussion. In the prosthetics laboratory of the Dental Technician School, the instructor sits at a worktable in the front of the classroom as he demonstrates how to make dental prostheses. A camera mounted over the worktable relays an enlarged image of the work to the classroom monitor.

A type of continuous TV monitoring is carried on at the Fleet Weather Facility. This facility is responsible for providing weather information to the air squadrons at North Island Naval Air Station. In the weather room the staff maintains a display board on which is recorded the present weather and weather forecast for North Island and other local air stations. This board is updated hourly. A television image of this display board is sent to monitors in the air control towers and the squadron ready rooms of each of the nine flight

squadrons stationed at this base. This system makes complete weather information available to pilots on a 24-hour-a-day basis. When weather warnings are placed on the display board, the central weather room alerts all monitoring stations with a buzzer, and each station must buzz back to indicate that the warning has been received.

e. Summary of Television Utilization Data. The most widespread use of TV, at the facilities visited, was for classroom instruction. Some facilities used mostly taped lessons, thus taking advantage of uniform lessons, presentations, convenience, and lessened demand on instructor time. Other facilities emphasized the use of live televised lessons as a means of overcoming the impersonal aspects of taped lessons while retaining the advantages of television presentation, such as increased class size and the special viewing characteristics of television. The Dental Technician School has further personalized live TV lectures by use of a two-way communication system which permits student questions during the televised lecture. Several facilities which preferred live lessons to taped lessons maintain a videotape library to be used when instructors are unavailable for live lesson presentation.

Adaptation of programmed instruction techniques to television appears to be a promising approach, especially for content such as flashing morse code which is of a highly visual nature.

The Dental Technician School course in preparing the dental room for the patient utilizes a teaching method which could be readily adaptable to many other types of skill training. Many advantages were realized in this course: student attention was maintained through active participation; the close-up and magnification advantages of TV were utilized; and each student was assured a good view of the demonstration by the use of a large TV monitor.

The military facilities visited have made extensive use of television for performance feedback. The method at the Landing Force Training Center of allowing a man to keep his own tape makes possible repeated utilization of televised feedback. The man may view the tape numerous times and, since a series of performances are recorded, he may compare consecutive performances to check improvement. The use of TV feedback for motor skill training has been relatively limited at the facilities visited, but is a procedure which would appear to have great promise as a potentially useful training method provided that standards for acceptable performance are available to the student.

The use of TV for monitoring purposes was rather diversified at the facilities visited. The subjects being monitored at the various facilities visited included radiation therapy room, weather information board, and flight deck. The use of television for monitoring permits economical widespread observation of some event, although if the event is taped the expense increases greatly. The use of TV to

monitor an event which is dangerous to observe at close range (such as radiation therapy) could be utilized in many other situations involving radioactive material and munitions.

Television magnification as a teaching aid was found to have limited but effective use. At the Machinery Repairman School and the Dental Technician School, the televised demonstration took place in the classroom so that students could observe the total situation as well as the magnified image of individual parts. Use of TV as a magnifying aid would seem to be applicable to many training situations in which the demonstration involves small parts.

The utilization of the special viewing capabilities of television was extensive at the medical facilities visited. The greatest handicap at these facilities seemed to be a special difficulty of medical corps facilities in obtaining trained personnel to operate and maintain the TV equipment.

The multi-use capabilities of several of the TV facilties visited were extremely efficient and economical. The PLAT system on the KITTY HAWK represents an example of very diversified usage of one TV system. The primary purpose of Pilot Landing Aid Television is served by the provision of televised information to the LSO and to control stations around the ship. Using the system to provide feedback to pilots helps improve individual pilot landing procedures, and use of the tapes for accident investigation helps improve landing procedures in general. A useful ancillary function of the PLAT system is to provide "entertainment" monitoring of the flight deck for the entire crew. The mobile island camera is also utilized for various special purposes such as an aid during docking.

The mobile capabilities at several facilities greatly enhanced the possible use of the TV system and would be a valuable asset to TV systems at facilities where much of the training is concerned with events occurring in the field.

E. Summary, Discussion, and Recommendations

The present report is intended to provide a broad survey of the current state of television training and related technology which will serve as a basis for assessment of the many existing and proposed utilizations of television in training contexts. The investigation involved a review and evaluation of relevant research literature and a personal survey of local operating television facilities.

The findings of the survey have been arbitrarily grouped here into four general areas of consideration for purposes of discussion and resultant recommendations regarding television utilization. The four areas include: (1) Standardization of equipment, (2) Training for television personnel, (3) Use of kinescopes, and (4) Versatility of television utilization.

1. Evaluative Discussion

a. Standardization of Equipment. The wide diversity of TV equipments has already been noted as a consistent finding of the survey of area television facilities. This situation is understandable in view of the fact that most of these facilities established TV systems to meet their individual needs as those needs arose. Many of these TV systems were set up by Navy personnel with relatively little knowledge or training in the area of television, and with little or no guidance from any Navy agency. State-of-the-art advances during acquisition periods combined with the somewhat piecemeal nature of the acquisitions resulted in a wide variety of equipment types and functions.

While diversity has certain advantages, it also has many drawbacks--a major one being incompatibility among equipments. There are several factors which must be taken into consideration in determining equipment compatibility. Some of the most important of these factors are: (1) Type of output, (2) Level of output, (3) Source of synchronization, and (4) Videotape characteristics.

(1) Type of Output. The three basic units of a TV system are camera, VTR, and monitor. Sometimes all three units are operated simultaneously and other times only two units are used according to the desired television function. For example, if an event is being viewed live and simultaneously recorded, a combination of camera, VTR, and monitor is required. For single functions, such as live viewing only, recording, or tape presentation alone, dual combinations of camera-monitor, camera VTR, or VTR-monitor will serve the appropriate function. The units operating together must be compatible with each other with respect to the type of signal or output. There are two basic types of TV signal--video and radio frequency. Cameras may be designed to send either one or both types of signal. A problem arises when the monitor is set up to receive a different type of signal than that being transmitted by the camera. The signal can easily be demodulated before entering the VTR so incompatibility of signal type creates no problem there.

When a video signal is being used, it is also possible to have incompatibility in signal polarity. The positive aspect of the signal may correspond to either the black or white portion of the TV image, so the units being used together must be set for the same polarity in order to avoid getting a negative picture.

(2) Level of Output. The individual units of the TV system must also be adjusted so that the end product of their individual signal amplitudes is within the range of usable levels. For example, a camera with a low signal amplitude output may be effectively used with a VTR which does not increase the level of output. The same is true of VTR-monitor and camera-monitor situations.

(3) Source of synchronization. Cameras can be operated with either an internal or external source of synchronization. When several cameras are used together in one system it is preferable to have an external sync source so that all cameras operate in the same sync. This permits smooth switching from one camera to another with no disruption of the video image. The ideal situation would be to use only cameras which can operate from either internal or external sync, thus permitting the camera to be either used alone or integrated into a system of several cameras.

(4) Videotape Characteristics. Probably the greatest incompatibility problem is that among VTR's. One would expect that the exchange of videotapes would be more practical and more prevelant than the exchange of pieces of equipment. Ideally a videotape could be played on any VTR, but unfortunately this is not the case. The VTR on which the tape was recorded and the VTR on which it is played must be compatible in at least three different respects: (a) Scan type, (b) Tape width, and (c) Transport speed.

(a) Scan type. The scan type is the pattern in which the recording heads of a VTR put the information on the tape. The two patterns used are helical and quadraplex. A tape recorded on a helical scan VTR cannot be played on a quadraplex machine and vice versa.

(b) Tape width. VTR's use either one-inch or two-inch tape. Tape widths are specific for each VTR and are not interchangeable for either recording or playing.

(c) Transport speed. There are a wide variety of speeds at which tape can be transported through a VTR. A tape can be played only on a VTR which operates at the same speed as the VTR on which the tape was recorded.

The Appendix lists each type of VTR found at any of the facilities visited. Since the three factors of scan type, tape width, and transport speed must be identical in order for the VTR's to be compatible, it is not unexpected that there are few of the VTR's which can readily exchange tapes.

From the foregoing it is evident that standardization of television equipment among facilities could result in greater interchangeability of videotapes. This could increase the usefulness of tapes made for general training purposes by allowing them to be used at a greater number of training facilities.

Standardization of television equipment would also help to decrease the cost of TV systems within the Navy. First, it would make it possible for the Navy to stock TV equipment and parts, thereby decreasing both acquisition and maintenance expenses. Secondly, there would be a decrease in the total amount of TV equipment needed.

As seen in the Appendix, there is a great deal of duplication of equipment from one TV facility to another. There is, of course, a necessary duplication in regard to the basic equipment needed to operate a TV system. There are, however, many less essential pieces of equipment such as extra cameras and special-use lenses which are infrequently used. If it were possible to share these types of equipment among a number of individual TV systems, it would eliminate much unnecessary duplication. This sharing would be possible only if the TV systems were mutually compatible. Efficient distribution of TV equipment among various facilities might best be accomplished by means of centralized agencies established to control a supply of lenses, special equipments, etc., sufficient to serve a designated military area.

b. Training of Television Personnel. The training facilities for TV operation and maintenance personnel within the Navy are apparently insufficient to meet present and projected requirements for these skills. The only formal training for television personnel is a 19-week course at Great Lakes in television operation and maintenance for enlisted men. This one course does not provide a sufficient number of trained personnel to staff the numerous TV facilities now existing within the Navy. The U. S. Army has a more extensive training program for television repairmen and has established a quota for Navy and Air Force personnel to help relieve the shortage of trained TV maintenancemen in these services. The Army's training program leads to a military occupational specialty in television repair. There is a movement within the Marine Corps also to set up a Military Occupational Specialty designation for TV specialists. In view of the strong probability that TV usage within the Navy will continue to increase, it is possible that a separate classification may similarly be required for TV personnel within the Navy.

An increase in Navy personnel trained in TV maintenance and repair would eliminate or at least decrease the number of cases in which a TV facility must establish a maintenance contract with a civilian firm. Training personnel in the operation of TV equipment would also tend to increase the quality of TV production.

The shortage of trained personnel in the area of TV production is even greater than in the maintenance area. The Navy offers virtually no training for the officers and petty officers who are placed in charge of production at TV facilities. Many of the OIC's at the TV facilities visited expressed a belief in the desirability of more extensive training in the field of television. The expansion of TV usage in the Navy would seem to call for establishment of some sort of formal training, at least to the extent of providing short courses in television production.

c. Use of Kinescopes. The advantages of kinescopes over training films in terms of production expense and time have already been

mentioned, and it seems reasonable to expect increasing use of kinescopes to replace training films.

Kinescopes could be used almost anywhere in the Navy because all that is necessary for viewing them is a projector and screen. This equipment is almost universally available within the Navy, whereas the VTR's necessary for playing videotapes are in rather short supply.

The main problem in increasing the use of kinescopes is the process of converting videotapes to kinescopes. This process requires special equipment. At the present time, the shortage of kinescope facilities limits the production of kinescopes within the Navy. There is only one kinescope facility in the San Diego area, and most of the TV facilities in the area do not have access to it. If kinescope usage is to be increased, it appears that more kinescope facilities should be established, or a centralized agency should be established to which videotapes can be sent for conversion to kinescopes.

d. Versatility of Television Utilization. While the use of TV to present standard taped lectures does have some advantages, such as uniform lessons, more complex demonstrations, service to larger student groups, economy of instructor time, and novelty, it has not been proved to be consistently more effective than live instruction. There are also disadvantages to this type of TV usage, such as its rather impersonal nature and inability to pace the lesson to accommodate individual class needs. Essentially this usage often merely reproduces the conventional lecture-demonstration lessons, and takes little advantage of the unique capabilities and special viewing properties of television. An attempt to take advantage of these properties has led several facilities to employ television as an instructional aid for the purposes of magnifying small parts, providing close-up views, and presenting highly visual programmed courses. Another promising usage is the method of presenting televised direction for some performance activity which the students imitate step by step in a programmed sequence.

The use of TV to provide a monitoring image could be greatly expanded to many Navy situations. Viewing hazardous areas from a distance, surveillance of security areas, and providing visibility to otherwise obscured areas, all serve as examples of existing monitoring functions accomplished via TV. The Medical Corps' use of televison to facilitate observation of fluoroscopes and radioisotope scans is another unique and significant application of television.

The use of television and videotape to provide performance feedback is one of the most demonstrably effective applications of television to training. Its use in instructor school, and elsewhere, has verified the assumption that modification of behavior can be greatly facilitated by allowing the learner to view objectively his own performance by means of both immediate and subsequent television

feedback. To be effective, the student should be supplied standards of excellent performance. The feedback capability of television is probably the single most promising practical application to training, with specific adaptability to situations involving skill acquisition, performance evaluation, and analysis of discrete portions of a performance skill.

Although military facilities have generally proved to be innovative in discovering new ways to utilize TV systems, there would be obvious advantages to increased exchange of information among facilities regarding different, broader, and improved methods of using television. This informational exchange, combined with greater equipment standardization, and personnel capability should result in increasingly effective exploitation of the potential capabilities of television as a major training resource.

2. Summary of Recommendations

A summary of the suggested approaches to television utilization follows in outline form:

a. Standardization of Equipment

(1) Standardize the types of cameras and videotape recorders and related equipments used at various Navy TV facilities.

(2) Institute Navy stocking of standardized TV equipment and parts.

(3) Set up central agencies to supply special use equipment and extra equipment to facilities within that area as needed.

b. Training of Television Personnel

(1) Increase the availability of training in TV maintenance and operation for enlisted men, perhaps within a special rating or designation.

(2) Establish training in TV production for officers.

(3) Supplement TV production and maintenance staffs with civilian employees where needed.

c. Use of Kinescopes

(1) Increase the production and use of kinescopes as a replacement for training films.

(2) Increase the number of kinescope facilities and/or establish a central agency to convert tapes into kinescopes.

d. Versatility of Television Utilization

(1) Emphasize the special viewing characteristics and unique capabilities of television (feedback, monitoring, etc.) in a maximum variety of training situations.

(2) Diversify and expand the training applications of existing televison systems.

(3) Facilitate the interchange of information concerning feasible television applications, among the various Navy facilities.

(4) Continue research to maximize the effectiveness of existing television utilizations, and to develop new or modified television applications.

APPENDIX

Description of Equipment at Military Television Facilities

Facility	Cameras		Lenses: Zoom		Lenses: Fixed	Recorders
Hospital Corps School	Dage IM320A Cohu 3900	(2) (1)	15-150mm	(1)	26mm (2) 50mm (2) 75mm (2)	Ampex 660B (2)
Dental Technician School	MTI VC6 Dage 70A Dage 70B Packard Bell 920	(2) (1) (1) (1)	25-150mm	(1)	1 in. (1) 2 in. (1) 4 in. (1) 6 in. (1)	Ampex 1560 (1)
Radiology Department	Cohu 20/20 Packard Bell 900 Cinelix Sieman	(2) (1) (1) (1)			1 in. (1) 2 in. (1) 4 in. (1) 6 in. (1)	Ampex 660B (1)
Urology Department	Delcalix	(1)				Ampex 660B (1)
Recruit Training Center	GPL 900 GPL 250 GPL 800 GPL 150	(2) (2) (1) (1)	15-150mm	(2)	1 in. (3) 2 in. (1) 3 in. (2) 4 in. (2)	Ampex 1100 (2)

APPENDIX (continued)

Facility	Cameras		Lenses: Zoom		Lenses: Fixed		Recorders
Naval Amphibious School	GPL 900	(3)	15-150mm 40-400mm 15-150mm	(2) (1) (1)	25mm 50mm 75mm 100mm 125mm 152mm	(3) (3) (3) (3) (2) (1)	Ampex 1100 (2) Ampex VR5100 (2)
Fleet Training Center	Panasonic WB-350P Ampex 324	(2) (1)	20-100mm 22.5-90mm	(1) (1)	12.5mm 50mm 75mm	(1) (1) (1)	Ampex VR7100 (1)
Fleet Anti-submarine Warfare School	Cohu 3100	(2)	12-120mm	(1)	1 in. 4 in. 6 in. 75mm	(1) (1) (1) (1)	Sony PV120U (3)
Machinery Repairman School	Ampex CC 324	(1)	22.5-90	(1)	90mm	(1)	None
Personnelman	Ampex C 324	(1)	17-68mm	(1)	12.5mm 25mm 50mm 75mm	(1) (1) (1) (1)	Ampex 7100 (1)
Instructor's School	Diamond STV-4 Ampex 324	(2) (1)	20-100mm 25-100mm	(2) (1)	25mm	(2)	Ampex 7000 (2) Ampex 7100 (1)

APPENDIX A (continued)

Facility	Cameras	Lenses: Zoom	Lenses: Fixed	Recorders
PLAT Control	0	0	-	Ampex 1100 (1) Sony PV-100 (1)
USS KITTY HAWK PLAT System	Marconi Mark IV (3) Dage 91 (1)	0	0	Ampex 1100 (1)
COMNAVAIRPAC	Ampex 326 (1) Ampex 324 (2)	22-90mm (1)	12.5mm (2) 25mm (2) 50mm (2) 63mm (1) 75mm (2) 152mm (1)	Ampex 7100 (2) IVC Corp 800(1) Sony PV120 (1) Sony PVU 120(1)
USS KITTY HAWK Entertainment	RCA TK11 (1) RCA TK15 (1)	(1)		Ampex 660 (1)
Fleet Weather Facility	General Electric(1)	20-100 (1)	0	None
Landing Force Training Center	Ampex 326 (2)	20-100mm (2)	10mm (1) 25mm (1) 50mm (1) 75mm (1) 100mm (1)	Ampex 660B (2)

APPENDIX (continued)

Facility	Cameras	Lenses		Recorders
		Zoom	Fixed	
Marine Corps Recruit Depot	Ampex 327 (2) Cohu 2020 (1) Cohu 3100 (1)	15-150mm (2) 25-100mm (1)	12.5mm (3) 25mm (2) 50mm (3) 150mm (1)	Ampex VR7000(2) Ampex VR7500(1)

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